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Figs. 3, 4, 5. Successive stages in the development of the antheridium; $\times 400$.

Fig. 6, a. Full grown antheridium; $\times 300$; b. stalk showing three rows of cells; $\times 400$.

Fig. 7. Three cross sections from the upper part of an antheridium; a. toward the apex; b. c. lower down; $\times 400$.

Fig. 8. Cross sections from the lower part of an antheridium, d. being the lowest segment; $\times 400$.

Fig. 9. Cross section of a full grown antheridium near the center; $\times 400$.

Fig. 10. a. Full grown spermatozoid; b. sperm-cell with nearly developed spermatozoid.

Notes on *Potentilla*.—I.

BY P. A. RYDBERG.

The author has been studying the genus *Potentilla* for some time. The plan is to prepare a revision of the North American Potentilleae and have it published as Volume 2 of the Memoirs from the Department of Botany of Columbia College. It is planned to contain, if possible, full size illustrations of all native species of *Potentilla*, *Horkelia*, *Ivesia*, etc. The best way the author knows of, to secure the coöperation of other botanists is to publish some of the results already obtained. He will regard it as a great favor to be permitted to look over and name any collection of North American species, and will be very thankful for any information, suggestion or criticism that may be given.

It will be seen from the following that my opinion as to the limitation of the species differs widely from those expressed in our manuals and from Dr. Watson's revision of *Potentilla* in the Proceedings of the American Academy of Arts and Sciences, 8: 549–573. They agree, however, very closely with those held by the late Dr. Christian Lehmann, of Hamburg. This eminent botanist after having studied the genus about forty years, having published several papers on it from time to time, among others a monograph in 1820, and having prepared the text for the genus *Potentilla* in Hooker's *Flora Boreali-Americana*, issued in 1856 his "Revisio Potentillarum," a quarto of 250 pages and 64 plates. This book, which always will remain as one of our standard works, will serve as the basis of my revision.

In the *glandulosa* group, Dr. Watson includes only two species, viz., *P. arguta* and *P. glandulosa*. Lehmann acknowledged five American species. Of these five, *P. brevifolia* Nutt., must be excluded as the style is not basal. For my part, I think the group contains at least seven or eight species. The additional species were not known to Lehmann, except *P. glutinosa* Nutt., which he included as a variety under *P. fissa* Nutt.

The group is characterized by an erect habit, more or less glandular pubescence, pinnate leaves with rounded or rhomboidal, coarsely toothed leaflets, obovate or orbicular, not emarginate petals, very flat anthers, and a nearly basal style, this last character, as far as I know, not being found elsewhere in the genus. In all except one, the style is also fusiform, *i. e.*, swollen near the middle and tapering to both ends. The species belonging to the group are:

POTENTILLA ARGUTA Pursh, Fl. Am. Sept. 736. 1814.

Geum agrimonioides Pursh, Fl. Am. Sept. 351. 1814. Not *Potentilla agrimonioides* Bieb.

This is the only eastern species of the group, extending from New Brunswick to District of Columbia, westward to the foothills of the Rocky Mountains, from Colorado, as far north as Fort Simpson on the Mackenzie River. It differs from the rest by its pubescence, which is coarser, densely hirsute and glandular, by its dense and strict cyme, and its white flowers. Dr. Watson mentions that in the Rocky Mountain region, there is found a form of *P. arguta* with bright yellow flowers. This is probably a mistake, and the specimens referred to belong to the next species.

POTENTILLA GLUTINOSA Nutt; Torr. & Gray, Fl. N. Am. 1: 446. 1838. As a synonym under

P. fissa major Torr. & Gray, *l. c.* Not *P. verna major* Wahl.

P. arguta Nutt. Journ. Acad. Phil. 7: 21. 1834. Not Pursh, 1814.

P. valida Greene, Pittonia, 3: 20. 1896.

It most resembles *P. arguta* in habit, is fully as stout and as pubescent, but the pubescence is finer, the longer hairs villous rather than hirsute. The cyme is open in age, rather flat-topped, the pedicels longer, the sepals thinner and more acute,

and the petals larger, much exceeding the calyx, and bright yellow. It ranges from Vancouver Island and British Columbia to Idaho and Oregon. A specimen also belonging here, without doubt, but less pubescent, has been collected in Utah by Marcus E. Jones. Fendler's no. 197, from Santa Fé Creek, New Mexico, which was included in *P. fissa major* by Lehmann, resembles the typical form except that the petals are smaller, scarcely exceeding the sepals.

POTENTILLA FISSA Nutt.; Torr. & Gray, Fl. N. Am. 1: 446. 1838.

P. glandulosa Am. Auth., not Lindley.

P. scopulorum Greene, Erythea, 1: 4. 1893.

The flowers resemble much those of the preceding, the petals being bright yellow, very large, orbicular, very concave, and much exceeding the ovate-lanceolate long-acuminate sepals; but the habit is very different. *P. fissa* is a low plant, seldom exceeding 2 dm. high, very bushy, with a narrow and few-flowered cyme; also often with some flowers in the axils of the leaves. The leaves most resemble those of the next, but the leaflets are generally more rounded and with stronger veins. The type specimens of *P. scopulorum* are less glandular than the original of *P. fissa*, but very glandular specimens have been collected even in Colorado. *P. fissa* occurs in the higher Rockies. It is common in Colorado, rare in Wyoming, Idaho and Montana.

POTENTILLA GLANDULOSA Lindl. Bot. Reg. 19: pl. 1583. 1833.

Resembles *P. glutinosa* in the open many-flowered cyme and general habit, but is a much more slender plant. It resembles *P. fissa* in the leaves, the long sepals and the shorter glandular pubescence, which is sometimes rather sparse. It differs from both by its petals, which are obovate, flat and about equal the sepals. Next to *P. arguta*, it is the most common and has the widest range of the group. It extends from British Columbia and Alberta to the Black Hills of South Dakota and the foot hills of New Mexico and California.

Suksdorf has collected a plant in West Klickitat Co., Wash., which agrees perfectly with *P. glandulosa*, except that the petals are very small, obovate-spatulate and white.

P. Hanseni Greene, Pittonia 3: 20, should perhaps be regarded as a mountain variety of *P. glandulosa* rather than a dis-

tinct species. It differs only in its more slender habit, a slightly denser pubescence, somewhat shorter sepals and a more contracted and few-flowered cyme, a modification perhaps due to the higher altitude. Intermediate forms are not rare. It is common in the higher Sierras of California, Nevada and Arizona.

POTENTILLA LACTEA Greene, Pittonia 3 : 20. 1896.

P. glandulosa lactea Greene, Fl. Frans. 65. 1891.

I can not pronounce on this, as I have not seen specimens. The description points toward *P. glandulosa*, except in the color of the petals, which are described as white.

POTENTILLA WRANGELIANA Fish. & All. Anim. Bot. Ind. Sem.

Hort. Bot. Petrop. 1840: 54; Ann. Sci. Nat. (II.) 16: 57. 1841.

P. rupestris Presl, Epim. Bot. 198. 1849. Not L.

P. glandulosa Am. Auth., as Brewer & Wats. Bot. Cal. 1 : 178, and Greene, Fl. Frans. 65, mainly.

This species most resembles *P. glandulosa*, but differs by the larger, more decidedly double-serrate leaflets, the more leafy cyme, which is dichotomously branched, with a short-pedicelled flower in the forks, but principally by the sepals, which are more veiny, oval (not ovate-lanceolate), and abruptly contracted into a small point, almost mucronate. The common form is inclined to become glabrate. Lindley's figure of *P. glandulosa incisa* in Bot. Reg. 23: pl. 1973, resembles this species as to the leaves, but the cyme and the sepals are those of *P. glandulosa*. *P. Wrangelliana* is common in California and Oregon, extending into Washington.

P. Oregana Nutt. Mss., is a form of this species, but the stem is glandular and very pubescent with long villous hairs. Torrey and Gray, Fl. N. Am. 1: 446, place it as a synonym of *P. glandulosa*, but its habit and sepals show a close relationship with *P. Wrangelliana*.

POTENTILLA REFLEXA Greene, Pittonia 3:19. 1896.

P. glandulosa reflexa Greene, Fl. Frans. 65. 1891.

This somewhat resembles *P. glandulosa*. The principal difference given by Prof. Greene is that petals and sepals are reflexed in anthesis. As far as I know the species, the following characters may be added: thicker, darker leaves with broader and shorter

teeth, a more slender stem which is inclined to be tinged with red, and a fruiting calyx scarcely larger than that of the next species. According to Prof. Greene, it is common in dry open pine woods of the foot hills of the Sierra Nevada. I have seen specimens from only two collections, viz., Coville & Funston, no. 1355, from Big Tree Cañon, Southern California, 1891; and Mrs. R. M. Austin, Modoc Co., Calif., 1895.

POTENTILLA RHOMBOIDEA n. sp.

P. glandulosa var. *Nevadensis* Wats. Bot. Calif. 1: 178, in part. 1876. Not *P. Nevadensis* Boiss.

Stem low and slender, about 2 dm. high, simple, about 3-leaved, not striate, nearly glabrous or glandular above, with very short hairs. Stipules small, 2–4 mm., ovate and subentire. Basal leaves many, short-petioled, about 3-paired, smooth or beset with a few scattered hairs. Leaflets rhombic-ovate, mostly acute, serrate with acute teeth, the largest ones $1\frac{1}{2}$ cm., seldom 2 cm. long. Stem leaves about 3, similar, the lowest pinnate with about 2 pairs, short-petioled, the other two generally 3-foliolate and subsessile. Flowers few in open cymes, about 1 cm. in diameter. Calyx glandular with very short hairs, sometimes also with a few long hairs; sepals about 8 mm. long in fruit. Bractlets linear-oblong, obtuse or acutish, half the length of the broadly ovate slightly mucronate sepals. Petals yellow, obovate, a little exceeding the sepals. Stamens 15–20. Style nearly basal, filiform, long and slender, in fruit about twice as long as the smooth achene.

It somewhat resembles depauperate *P. glandulosa*, but differs by its longer filiform style, which is not fusiform, by the pubescence which could be called glandular-pruinose, when present, with a few scattered straight hairs on the calyx and the leaves, and by the small fruiting calyx. It reminds us also of *P. brevifolia*, but in the latter the style is not basal and the petals emarginate.

P. rhomboidea is apparently a rare plant. The following specimens have been seen by me:

Nevada, S. Watson; *Montana*, S. Watson, no. 114; *Washington*, W. V. Suxsdorf (Mt. Paddo), 1885; *Oregon*, Thomas Howell (Deer Creek Mts.), no. 1128, 1887.

To this group belong also *P. geoides* Bieb. of Tauria, *P. rupestris* L. of Europe and northern Asia, and *P. macrocalyx* Huet du Pav. of the Pyrenees.